MEDICAL ASPECTS OF DISASTER PREPAREDNESS AND RESPONSE: A SYSTEM OVERVIEW OF CIVIL AND MILITARY RESOURCES AND NEW POTENTIAL

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INTRODUCTION

A disaster (in the federal government lexicon) is defined as a low probability, high impact event that overwhelms the local emergency resources requiring the deployment of surge capacity assets to the scene from outside the impacted area (Arday & Gaffney, 2004). In this sense, mass medical emergencies are similar to any other type of disaster preparedness and response except that medical disasters involve human casualties. A "mass casualty incident" is a mass medical emergency that does not overwhelm local response and medical assets, though it may still be referred to as a "disaster" locally (Geiling, 2004).

The term "catastrophe" is a term of art connoting a larger scale calamity that requires a comprehensive federal emergency intervention of a proactive or largely self-directing nature. This is because the hugely degraded local first responders in the midst of a veritable social breakdown may not be able to identify or communicate accurate disaster assistance needs to higher authorities (Rude, November 1, 2005). For the purposes of this article, we will posit that typical disasters do not need a national military response, but catastrophes do (Catastrophe versus disaster, n.d.) (see Table 1).

Table 1. Emergency Incident-Disaster Continuum

Event	Characteristics	Example
Mass casualty incident	• Local emergency response capable of handing incident • Outside assistance not required (but may be used) • Communications intact	• Crash of AA Flight 587 (2001)
Disaster	• Local response capability overwhelmed • Outside assistance required to provide for casualties, rescue, or recovery • Communications disrupted • Federal disaster declaration (usually)	• Hurricane Ivan (2004) • World Trade Center terrorist attack (2001)
Catastrophe	• Local response capability decimated • Proactive external assistance required to both handle casualties and coordinate most or all aspects of the response effort • Extensive loss of communications • Federal disaster declaration • Military response indicated	• Hurricane Katrina (2005)

An alternate view of large-scale emergencies is to classify them not by the cause, but by the event's impact. In this view, the two categories are populations and infrastructure; note that the term 'population' need not specifically refer to humans, but may also include pets, livestock, and wild animals (Arday & Gaffney, 2004). Obviously, saving human lives takes priority over saving animals and infrastructure, but Hurricane Katrina showed that some people died and many risked their lives to save

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their pets, which has led to increased attention to animal protection and relief by emergency health planners at all jurisdictional levels. Any discussion on medical disasters, however, is best served by focusing on the human population.

MEDICAL DISASTER PLANNING OVERVIEW

Response planning for a true medical disaster generally involves four functional levels: (1) local private and government emergency response, including local surge capacity; (2) initial treatment facilities; (3) local and state government departments (public health, emergency services); and (4) federal agencies. Although each level develops its own plans, the goal is to achieve functional interoperability between all levels. Ideally, plans developed at any functional level will complement those at the levels immediately above and below.

Disaster health planning can also be examined through the lens of the disaster mitigation model of ***preparation***, ***response*** and ***recovery***, which roughly parallels the public health model of primary, secondary and tertiary prevention. Disaster preparation, or pre-disaster mitigation (PDM), involves the development and implementation of all-health hazard mitigation projects designed to limit casualties when disaster strikes.

Preparation: Pre-incident preparation activities include health surveillance, vulnerability analyses, and strengthening health emergency infrastructures, including the recruiting, supply and training of first responders and surge medical reach-back personnel, as well as joint field training between Emergency Management Agencies (EMAs), Emergency Medical Services, Local Emergency Planning Committees, academic health institutions and other non-governmental health service organizations [Center for Disease Control (CDC), n.d.].

Response. When a major disaster strikes, all four of the planning levels mentioned above respond by performing direct disaster mitigation during the acute phase. Responses will vary according to the nature of the emergency. A mass casualty terrorist attack, for example will involve the transportation of seriously ill patients to intensive care and trauma programs, followed by definitive hospital care. During such events, hospitals will scramble to maximize their emergency capacity, but the inevitable overflow will trigger hospital triage, sending the walking worried and wounded to field treatment centers where fist aid and basic life support will normally be administered.

If the event involves hazardous materials (HAZMAT), for example, then decontamination and evacuation will be priorities, followed by medical triage and treatment. The incipient outbreak of mass infectious disease may entail mass emergency inoculations, perhaps drawing upon the CDC's strategic stockpile of medical supplies if local resources are depleted. There is an almost limitless array of other possible health response objectives including, body recovery, forensic and mortuary services for mass fatalities, as well as medical transport, sanitation and possible veterinary response and animal rescue efforts (CDC, n.d.).

Recovery: Post incident mitigation (recovery) follows the acute phase. The goal of post incident mitigation is to restore the health infrastructure to its pre-incident status and to maximize the affected population's remaining health potential. Activities include, for example, continued and even long-term casualty care, ongoing mental health reassessment and counseling, and public health program restoration, among many other long-term health objectives.

When considering recovery, a key aspect of disasters and their impact needs to be kept in mind. While acute casualties are the primary concern of medical personnel preparing for and responding to a disaster, the greater impact of most disasters within the U.S. has been and will likely remain the subsequent disruption of daily life, which can extend for months or years after the disaster's immediate or acute phase. These disruptions result from: (1) loss of infrastructure and other economic after effects; (2) from heightened vigilance and psychological effects; and (3) from the loss of life and the long-term needs of the injured. More than a year after Katrina, New Orleans exhibits all three of these long-term after effects and their resultant disruptions.

All Disasters Are Local: The well-known mantra of emergency planners everywhere is the old bromide that "all disasters are local." Whether or not a disaster involves a federal response - or rises to the level of a catastrophe, mandating a federal response - the fact is, the great majority of events are handled by local police, fire and emergency responders along with community hospitals. Larger, multi-jurisdictional disasters, requiring neighboring emergency resources, are coordinated by county emergency management agencies (EMAs), which in turn can also be activated and coordinated by state emergency management agencies, through each state's Emergency Operation Center (EOC).

State EMAs are the lead state agencies for analyzing disaster information and disseminating findings, issuing warnings, and for actually coordinating state, federal and local private and public disaster response operations through the implementation of the first responder Incident Command System (ICS) in the impact area. Larger regional disasters or catastrophes require a higher-level area incident command system to coordinate the multi-tiered responses by multiple geographically coordinated ICSs.

Private and Public Disaster Response Agencies: Although this article focuses on state and federal government disaster response efforts, it bears mentioning that America's non-governmental (nonprofit or third sector) emergency response efforts represent a huge relief capacity that is crucial to all mitigation phases, but especially to the immediate post acute and long-term recovery phases. The American Red Cross and Salvation Army, for example, are easily the largest and best known of a myriad of volunteer secular and faith-based disaster response agencies that add considerable heft to disaster relief efforts by pushing out and sustaining large numbers of organized volunteers and supplies into disaster zones to provide shelter management, food services (to both victims and rescuers), as well mental health and financial support to victims, among many other services (Red Cross builds, 2007; *American Red Cross disaster response functions*, n.d.).

Academic institutions are also crucial to disaster planning and preparedness through their general disaster research initiatives, as well as their research on various threats including geological, HAZMAT, engineering failures, meteorological crises and all aspects of emergency and disaster medicine.

The remainder of this article addresses medical threats across all four functional planning levels. It also discusses state and federal emergency medical system shortages and coordination problems, and examines when and what federal and state civil and military medical resources might be brought to bear to during and immediately after a disaster.

CURRENT MEDICAL THREATS

Potential U.S. mass casualty medical threats fall into two major categories: (1) natural; and (2) manmade disasters. The latter may be sub-categorized as accidental or intentional (see Table 2). In the broadest terms and in an average year, one would expect about 1,000 U.S. deaths and perhaps 6,000 to 10,000 injuries to occur as a result of roughly 25 extraordinary events that would be called "disasters." Typically, there are fewer than 15 events per year that cause more than 40 deaths each (Hogan & Burstein, 2002). Yet, no year is truly average. In 2001, for example, there were four times the expected number of deaths, due largely to the 9/11 terrorist attacks and the subsequent American Airlines crash in Queens, NY two months later. And prior to hurricane Katrina, in 2005, expected annual hurricane deaths were only about 25, based on the previous 30 years.

Table 2. Leading Threats With the Potential to Cause Mass Casualties Within U.S. Borders and Expected Annual Death Toll, Based on Past 30 Years Experience.

Type of Disaster	Annual Expected Annual Deaths
Natural Disasters	
Hurricanes	90[a]
Tornadoes	65
Floods	85
Earthquakes	10[a]
Wildland/urban interface fires	30[b]
Volcanoes	2[a]
Heat waves and hot weather	200
Cold waves and winter storms	70
Tsunamis	0[a]
Pandemics	0[a]
Manmade Disasters	
Accidental	
Aircraft crashes	120[c, a]
Other transportation accidents	80[b]
Industrial accidents (HAZMAT, mining)	30[b]
Structural failures	10[b]
Major structural fires	30[b]
Terrorism/International	
Conventional explosive and incendiary weapons[d]	150[a]
Bioterrorism	1[a]
Chemical weapons	0[a]
Radiological weapons (dirty bombs)	0[a]
Nuclear explosions	0[a]

[a] Some years with few or no fatalities.
[b] Estimate based on events with 10 or more fatalities, only.
[c] Excludes general aviation. Expected number reduced due to declining trend.
[d] Most arson cases excluded.

Natural Disasters: Despite the recent attention to the threat of terrorist attacks, natural meteorological and geophysical disasters remain the most immediate threat and the primary cause of disaster related casualties within the U.S.

The deadliest point-in-time disaster in U.S. history was the 1900 Galveston hurricane that killed 10,000 people. Although improved weather forecasting and evacuation planning greatly reduce the likelihood of another Galveston scale event, rapid coastal area population growth over the years has sharply increased the number of people at risk. Katrina's 1,800 total fatalities and tens of thousands of injured or displaced persons needing urgent medical attention prove that hurricanes remain a disaster threat. In fact, former National Hurricane Center Director Max Mayfield, worries that "10 times as many fatalities could occur in what he sees as an inevitable strike by a huge storm during the current highly active hurricane cycle, which is expected to last another 10 to 20 years" (Williams, January 3, 2007).

Conversely, in recent years, floods, tornadoes, heat and cold waves have together killed fewer than 500 people annually, though they do so with some consistency. There have been only a handful of fatal earthquakes, only one deadly volcanic event (Mt. Saint Helens) and no tsunamis have swept the U.S. since 1964.

Although strong catastrophic earthquakes and tsunamis are rare, they pose the greatest potential mass casualty threat to U.S. citizens, especially if they if they strike with little or no warning. Consider, for example, the New Madrid Fault Line, in the lower Mississippi Valley. In the early 19th century, it caused three of history's most powerful tremblers (measuring an estimated 8 points or higher on the Richter scale) shattering this area. Back then, however, there were very few European inhabitants in this region. Now, more that 12 million people live there, many in structures that were not built with earthquakes in mind (Central United States Earthquake Consortium, 2006).

And while it is the point of some scientific debate, the Benfield Grieg Hazard Research Centre at University College London warns that a volcanic explosion on Mt. Cumbre Vie Ja, on the Canary island of La Palma, could send a monstrous landside into the sea hurling an unprecedented 60 foot high (at impact) tsunami traveling hundreds of miles per hour towards the East Coast, dooming thousands to injury and death (Atlantic ocean tsunami, September 2005). Simply consider that the Asian Tsunami of 2004 killed nearly 270,000 people in the space of a few hours, a truly catastrophic event.

Despite ongoing threats from severe weather and geologic events, the deadliest disaster in U.S. history was the 1918-19 Spanish flu pandemic, killing roughly 600,000 Americans (and many millions worldwide). It is sobering to note that most of these deaths occurred in a few short weeks in the autumn of 1918, overwhelming hospitals, medical personnel, and morgues across the nation. A second, smaller wave of transmission and death occurred again in early 1919.

As of this writing, 270 people have contracted and 164 of them have died of the avian flu worldwide (World Health Organization, January 29, 2007). A new worldwide influenza pandemic, perhaps caused by the emerging H5N1 strain of avian influenza, could rival the 1918-19 Spanish flu. It would clearly overwhelm local response efforts and fundamentally devastate America's business community (Crimando, December 2006). One report estimates as many as 142 million would die worldwide and many times that number would need acute and subacute care, and economic devastation would exceed four trillion dollars (*An analysis of the potential impact*, August 2005). This would surely overwhelm America's hospitals and primary care facilities, necessitating the establishment of surge capacity sub-acute treatment in nursing homes, retirement homes, school gymnasiums and other public and private institutions.

Furthermore, such an event would likely stifle the normal type I (neighbor to neighbor helping) response that occurs in virtually all weather and manmade disasters, as the fear of contagion grips the citizenry and causes widespread "bunkering," which is a type II, isolation oriented, threat-avoidance response. Cremando estimates that in this circumstance, half of all public healthcare workers would avoid the dangers of working, despite the greatly increased need (December, 2006).

Shortages of primary caregivers, acute care beds, ventilators, vaccines and antiviral medicines, coupled with the inevitable prioritizing of patients (seemingly abandoning whole segments of society), could further lead to a type III response, which constitutes panic. Panic "arises from two perceptions: (1) the perception of limited opportunity for escape; and (2) the perception of limited availability of critical supplies" (Crimando, December 2006). Panic destroys social cohesiveness, incites violence, looting, anarchy, murder and mayhem, and, in the worst cases, even pushes desperate caregivers to abandon or even to euthanize their charges, as happened during Katrina.

To say that the range of adverse mental health effects following such a horror would be widespread is, of course, an understatement. The need for critical incident stress management teams to mitigate the serious emotional impact for those most severely affected could not possibly be met in the worse cases scenarios. And even long afterward, an estimated "11-15% of affected population will need long-term assistance, requiring a multilevel approach involving both some public health assets, as well as private business employ assistance programs in order to assure any chance of a normal business recovery over time" (Crimonda, December 2006).

While no influenza pandemic similar to the Spanish flu has occurred since 1919, even with today's usually effective vaccines, influenza kills an average of 36,000 Americans annually (Arday & Gaffney, 2004), far more people than all of the disasters listed in Table 2. Yet, even though influenza is perennial and widely threatening, the actual percentage of those who die is very low, and extant medical resources can handle the afflicted with little difficulty. Consequently, people don't fear the annual flu outbreaks the same way as they fear the equally predictable seasonal hurricanes or tornados, or less predictable terrorist attacks - all of which are sure fixtures in our future.

Manmade Disasters: Manmade disasters are either unforeseeable accidental events or they are deliberate attempts to kill and injure targeted groups. Accidental manmade disasters include mass casualty vehicular crashes, chemical and other HAZMAT releases, explosions, abrupt structural failures, large urban fires or suburban wildfires, and any other major unplanned event that causes or threatens acute loss or injury.

Because many such events (e.g., fatal traffic accidents) occur with high frequency but result in few deaths per occurrence, it is hard to determine how many of these episodes nationally actually constitute true "disasters" by our definition. Laymen, for example, consider a drunk driving crash that kills a carload of teenagers a tragic "disaster" for a local community, but this is not likely to require outside resources. On the other hand, a 100-car pile-up on a foggy rural interstate highway that kills 12 people and injures 30, will in all likelihood overwhelm local emergency responders, making this a true disaster, albeit a small one.

Ironically, an aircraft crash that kills ten times as many people, but seldom leaves anyone alive to rescue, triage, or treat, is almost always effectively managed by the local first responders. Hence, despite many more per incident fatalities, such events are often characterized as mass casualty incidents as opposed to disasters (see Table 1).

A hazardous material release - chemical, biological, radiological, nuclear or explosive (CBRNE) - in a populated area is much more likely to constitute a disaster (or in some cases, a catastrophe) than even a colossal highway pile up. The horrific industrial release that occurred in Bhopal India in 1984 killed nearly 4,000 people and injured and disabled many thousands, overwhelming India's regional (and to some extent national) resources. It required a massive international intervention of human and material medical support. Post incident mitigation (recovery) lasted for years and even entailed the funding of special medical research conferences to identify best treatment modalities for the disaster's many permanent victims (*Incident response,* 2006).

Although natural disasters remain the most consistent threat, emerging terrorist threats since 9/11 have increased the citizenry's threat consciousness and heightened sense of vulnerability, which has motivated greatly increased preparations to mitigate deliberate terrorist slaughter. Consequently, terrorism threat planning has consumed most disaster preparedness resources in recent years. Much

effort has been directed toward improved rapid detection of a bioterrorism or chemical weapons attack, improved interoperability of communications systems, upgrading of equipment for first responders, and increased planning at all levels. Despite these efforts, it remains apparent that more needs to be done to reach what might be considered to be optimal readiness.

Among the types of terrorist attacks listed in Table 2, conventional weapons and explosives are clearly the most frequently used. However, bioterrorism has already taken place twice in the U.S. Before the 2001 anthrax attacks, there was a 1984 salmonella attack in Oregon, initiated by a cult follower of the Baghwan Shree Rajneesh, that sickened about 750 people, of whom 45 were hospitalized (Hugh-Jones & Brown, 2006). A 1995 sarin gas attack in Tokyo sent more than 5,500 people into hopitals for assessment. A thousand of these were diagnosed as moderately to severly ill, while the great majority constituted the "walking worried" who demanded medical attention to assuage their rational anxiety about contamination (Taneda, 2005, p 75). In 1995, a Moscow businessman was killed by a direct release (as opposed to explosively dispersed) radiological attack (Cameron,1996).

Only the intentional detonation of a radiological ("dirty") bomb or of a nuclear device remain unfulfilled threats. It is clear that, a nuclear attack in a major metropolitan area would be a worst case scenario and true catastrophe in terms of both total deaths and injuries, and would vastly overshadow the 9/11 attacks should it ever occur. The Homeland Security Council estimates that a modest 10-kiloton bomb detonated in Washington D.C, would kill from 99,000 to 300,000 people depending on the wind drift and other factors (cited in Mintz, May 3, 2005). Mass triage would be stunningly grim as medical providers would be forced ignore huge numbers of victims deemed too sick to recover (Mintz, 2005).

Although a detailed discussion of terrorist attack planning and response is beyond the scope of this article, a couple of points are worth mentioning. Explosive or conventional weapons, most chemical weapons, or a nuclear attack will result in immediate casualties and high patient flows. On the other hand, release of a bio-weapon or the non-explosive spread of radiological material will likely result in an incubation or latency period lasting hours, days, or even weeks. Barring detection of the attack by prepositioned sensor equipment, initial identification of the attack may only be accomplished through what is called "syndromic surveillance" - essentially hypervigilence on the part of medical personnel for excessive numbers of patients with certain complaint patterns (see Table 3, below). In either type of attack, once word of the attack spreads, more "worried well" or mildly exposed patients may appear at medical facilities seeking help than truly injured victims of the attack (Auf Der Heide, 2002).

THE NATIONAL DISASTER MEDICAL SYSTEM (NDMS) AND NATIONAL RESPONSE PLAN (NRP)

The NDMS is a cooperative asset sharing partnership among the Department of Health and Human Services (HHS), the Department of Defense(DOD), the Department of Veterans Affairs (VA), and the Department of Homeland Security (DHS). NDMS operations entail a highly coordinated, multi-agency local, State, and Federal effort.

The statutory mission of NDMS is to organize a coordinated effort by the NDMS Federal Partners, working in collaboration with the states and other appropriate public or private entities to provide health services, health-related social services, other appropriate human services, and appropriate auxiliary services to respond to the needs of victims of a public health emergency, and to be present at locations, for limited periods of time, when such locations are at risk of a public health emergency.

NDMS also provides resources and assets to support federal government activities under Emergency Support Function (ESF) #8, Public Health and Medical Services, of the National Response Plan (NRP). Further, the federal partners agree that NDMS also continues the availability of the NDMS hospital network as backup to military and veterans' hospitals in a military health emergency.

Table 3. Symptom Patterns That May Indicate a Previously Unsuspected Bioterrorism or Radiological Attack If Suddenly Seen At a Much Higher Rate Then Usual[a]

- Gastroenteritis of any apparent infectious etiology
- Pneumonia with the sudden death of a previously healthy adult
- Widened mediastinum in a febrile patient without another explanation
- Rash of synchronous vesicular or pustular lesions
- Acute neurological illness with fever
- Advancing cranial nerve impairment with progressive generalized weakness
- Nausea, vomiting, or diarrhea accompanied by abnormally low blood cell counts

[a] Adapted from Burkle, 2002.

Prior to March 1, 2003, the HHS Office of Emergency Response functioned as the overall action agent for coordinating the implementation of health and medical services delivery in the event of an NDMS activation. This included the development and oversight of NDMS medical assistance teams, as well as the planning and coordination of patient evacuation and definitive care. With the standing up of the new DHS, however, all responsibility for the NDMS response teams shifted to the DHS Emergency Preparedness and Response Directorate (also known by its pre-DHS acronym of FEMA), while most of the non-NDMS related health response planning and coordination function remained in HHS. During this brief period, four cabinet level federal agencies provided oversight and support to the NDMS: DHHS, DHS, DoD, and the VA (Arday & Gaffney, 2004).

This all changed on December 19, 2006 when the President signed the Pandemic and All-Hazards Preparedness Act (Public Law No. 109-417), which returned primary responsibility for coordinating the federal response to public health and medical emergencies to the HHS Secretary, effective January 1, 2007. Under this act, the NDMS will still retain its three primary functions, which are: (1) medical response; (2) patient evacuation; and (3) definitive care. Upon activation, the NDMS can respond to a disaster location with a variety of medical assistance teams. In the event of an overwhelming number of casualties, arrangements can be made to evacuate patients from the local disaster area to other areas of the United States. And once those patients are evacuated, the NDMS has a network of approximately 1,800 participating hospitals that can provide definitive in-patient care to casualties.

Activation of the NDMS and its disaster response teams may occur as a result of five circumstances. First, and foremost, is to respond to a Presidential disaster declaration, under the authority granted by the Stafford Act (full title: Robert T. Stafford Disaster Relief and Emergency Assistance Act). Second, if a disaster has not occurred, HHS may activate the NDMS under its own authority in anticipation of an event, or to support a state governor's or other federal agency's request for major medical assistance. This is often done to support special events of national significance [known as a National Specialty Security Event (NSSE) if so designated] such as the Olympics or a national political convention, where prepositioning disaster response assets is merely prudent planning. Third, the National Transportation Safety Board may request activation to support their response to a transportation accident. This usually involves a Disaster Mortuary Operational Response Team (DMORT), to assist with victim recovery and identification. Fourth, the State Department may request NDMS activation in the event of a disaster involving U.S. nationals overseas (e.g., an embassy

bombing). Finally, the NDMS may be activated at the request of DoD, should an overseas military conflict result in an overwhelming number of casualties returning to the U.S.

In the event of NDMS activation, the basic operational concepts are found in the National Response Plan (NRP) which prescribes how all federal agencies mobilize resources to support state, local, territorial, and tribal government responses to major disasters or emergencies involving any type of hazard. The NRP establishes and describes policies and planning assumptions, and outlines federal actions and capabilities that can be activated to support state, local, territorial and tribal government response efforts during a specific crisis episode. The NRP also establishes a means of facilitating federal and state coordination during response operations. This coordination is through the aforementioned Incident Command System (ICS), which is itself part of the National Incident Management System, or NIMS. Adoption of both the NRP and NIMS is mandatory for all federal agencies, and is a prerequisite for any private or public agency applying for federal disaster or terrorism preparedness, response, mitigation, or recovery funds (Department of Homeland Security, December 2004).

The National Response Plan details how 27 federal departments and agencies along with the American Red Cross (which functions as a federal agency pursuant to this plan) will respond to a disaster or catastrophe by allocating human and material resources to the states following the President's issuance of a Federal Disaster Declaration under the Stafford Act. FEMA steers other federal lead agency activities through the FEMA appointed Federal Coordinating Officer (FCO) who supervises the multi-level implementation of the plan by assigning resources and responsibilities according to the NRP's 15 Emergency Support Functions (ESFs), which are listed in Table 4.

Table 4. Emergency Support Function (ESF) Areas Within the National Response Plan.

ESF No.	ESF Area
1	Transportation
2	Communications
3	Public Works and Engineering
4	Firefighting
5	Emergency Management
6	Mass Care, Housing, and Human Services
7	Resource Support
8	Public Health and Medical Services
9	Urban Search and Rescue
10	Oil and Hazardous Materials Response
11	Agriculture and Natural Resources
12	Energy
13	Public Safety and Security
14	Long-Term Community Recovery and Mitigation
15	External Affairs

Each of these ESF functions is assigned a lead agency. For instance, Mass Care, Housing and Human Services (#6), which involves the provision of food, shelter, basic first aide and so forth, is the lead responsibility for the American Red Cross. Public Health and Medical Services (#8), which involves a host of health functions from disease surveillance and control, to mass casualty triage, patient assessment, definitive care, evacuation and mortuary services, among others, is the responsibility of HHS. These two lead agencies (as with all lead ESF agencies in the NRP) have state and local level partners. The American Red Cross has state and local Red Cross Chapters as well as a myriad of other local not-for-profit voluntary relief agencies to support it in a crisis. HHS will coordinate its NRP initiatives with state and county health departments, which have their own operational plans detailing their jurisdictional responsibilities to meet the primary ESF functions. An important aspect of ESF #8 involves medical surge capacity, to which we now turn our attention.

NDMS Teams

As of April 2006, The NDMS counted among its disaster response resources 100 separate response teams categorized into eight different types (see Table 5). Of these eight, the Disaster Medical Assistance Teams (DMATs) are further subdivided into specialty teams such as burn, pediatric, mental health, and crush response teams. There are also four levels of teams (see Figure 1, below) rated by their ability to field, equip and sustain their mixed compliments of doctors, nurses, EMTs PAs, paramedics and support personnel in the field for a stipulated period of time. For example, fully functioning, 35-member, Type I DMAT teams can deploy on short order and sustain themselves in the field for three days. These teams have met the highest readiness designation by satisfying all NDMS training, personnel and equipment requirements, along with having prior deployment experience, including a demonstrated ability to mobilize rapidly and perform its mission under austere conditions.

Table 5. Current NDMS Response Team Assets[a]

No. of Teams	Type of Teams
	DMAT Specialty Teams
37	Disaster Medical Assistance Teams (Fully Operational/Operational)
15	Disaster Medical Assistance Teams (Augmentation/Developmental)
4	National Medical Response Teams (WMD capable)
4	Burn Teams
2	Pediatric Teams
1	Crush Medicine Team
	Other Teams
3	International Medical/Surgical Teams
2	Mental Health Teams
4	Veterinary Medical Assistance Teams
11	Disaster Mortuary Operational Response Teams (One WMD capable)
10	National Pharmacist Response Teams
10	National Nurse Response Teams
1+	Management Support Team(s) (as needed)

[a]Source: National Disaster Medical System, April 2006.

For an all-out effort such as the hurricane Katrina response, NDMS was prepared to field a total of 72 teams and had 57 teams in the field by the third day after the hurricane struck - an impressive record in the abstract, yet insufficient under the extreme circumstances.

As Figure 1 shows, not all DMAT teams are fully operational 100% of the time, some teams may be short of personnel or equipment, may be newly organized and still under development, or - in the case of different types of teams that are geographically co-located - may share resources with another team. In this last context, some of the NDMS National Medical Response Teams (specialized teams trained for post WMD decontamination and treatment), or the 200-member National Nursing Response Teams (NNRT) (which are primarily targeted to provide mass pre or post incident inoculations) share personnel and resources with geographically co-located standard DMATs. It goes without saying that such co-located teams cannot be deployed simultaneously. Figure 2 (see below) illustrates the geographic locations (home bases) of the NDMS DMATs.

Although personnel or equipment shortages prevent teams designated at the augmentation and developmental (Type III and IV teams) levels from deploying effectively as a full team, they may supply individuals to supplement a standard DMAT deployment complement of at least three physicians, four physician assistants or nurse practitioners, eight nurses including two supervisory nursing specialists, four paramedics or emergency medical technicians, one pharmacist and one pharmacy assistant. Most

Resource: Disaster Medical Assistance Team (DMAT)–Basic

Category: Health & Medical (ESF #8)
Kind: Team

Minimum Capabilities (Component)	Minimum Capabilities (Metric)	Type I	Type II	Type III	Type IV
Overall Function (see Definition and NOTE 1)	Patient-Care Capabilities	Triage and treat up to 250 patients per day for up to 3 days without resupply	Triage and treat up to 250 patients per day for up to 3 days without resupply	Augment or supplement Type I or II team within this team's local area	Personnel may be used to supplement other teams
Personnel and Equipment Readiness	Roster Fulfillment, Equipment Loading	Upon alert, full 35-person roster within 4 hours. After activation, deployment ready within 6 hours	Upon alert, full roster within 6 hours. After activation, deployment ready within 12 hours	Upon alert, 75% rostered within 12 hours. After activation, deployment ready within 24 hours	Does not meet minimal deployable team requirements
Demonstrated Readiness	Readiness Testing and Deployment History	100% rating on NDMS readiness test in past 12 months. History of prior full deployment to austere environment	100% rating on NDMS readiness test in past 12 months	75% or greater rating on NDMS readiness test in past 12 months	Less than Type III
Personnel Standard DMAT deploys with 35 personnel for all missions (NOTE 2)	Membership Level	105 or more deployable team personnel on NDMS roster; 12 or more physicians; 3 or more of each of PA or NP, RN, RPh, and paramedic	90 or more deployable team personnel on NDMS roster; 9 or more physicians; 3 or more of each of PA or NP, RN, RPh, and paramedic	50 or more deployable team personnel on NDMS roster; 6 or more physicians; 2 or more of each of PA or NP, RN, RPh, and paramedic	Less than Type III.
Shelters, Equipment, and Supplies	Logistics Status	Full DMAT equipment cache properly managed, stored, and inventoried per NDMS requirements	Full DMAT equipment cache properly managed, stored and inventoried per NDMS requirements	Full or partial DMAT equipment cache properly managed, stored, and inventoried per NDMS requirements	Less than partial cache.
Transportation	Vehicle Status	Pre-arrangement for obtaining primary and alternate use vehicles	Pre-arrangement for obtaining primary and alternate use vehicles	Incomplete transportation arrangements	None

Minimum Capabilities (Component)	Minimum Capabilities (Metric)	Type I	Type II	Type III	Type IV
Didactic Training	Basic (Core) and Advanced Training Modules	90% completion of NDMS basic core training plus 50% of advanced training modules (By 08/05)	80% completion of NDMS basic core training plus 25% of advanced training modules (By 08/05)	50% completion of NDMS basic core training plus 25% of advanced training modules (By 08/05)	Less than Type III
Training Experience	Field Exercises (FEXs)	Participate in at least 2 NDMS approved FEXs, one observed	Participate in at least 2 NDMS approved FEXs, one observed	Participate in at least 1 NDMS approved FEX	N/A

Definition: A DMAT is a volunteer group of medical and nonmedical individuals, usually from the same State or region of a State, who have formed a response team under the guidance of the National Disaster Medical System, or under similar State or local auspices.
NOTE 1: TYPE I = fully operational; Type II = operational; Type III = augmentation/local team; Type IV = developmental.
NOTE 2: Personnel include a mix of physicians, nurses (RN), nurse practitioners (NP), physicians' assistants (PA), pharmacists (RPh), emergency medical technicians (EMT), other allied health professionals, and support staff.

Figure 1. NDMS/FEMA Resource Classification Criteria For Basic DMATs[a]

[a] The information in this figure is no longer fully current; however, the correct information is in flux and this information was posted on the NIMS website pending revision.

DMAT medical professionals have training in emergency medicine or a primary care specialty and are certified in advanced trauma life support and advanced cardiac life support. There are also several non-medical personnel, including logistics, communications, safety and administrative personnel. To ensure the ability to muster and deploy personnel rapidly, a team should be at least three deep at each position, and a fully operational DMAT will have over 100 volunteers on its roster. In fact, some DMATs have over 200 volunteers (Arday & Gaffney, 2004).

Historically, NDMS teams were organized by a local sponsor, such as a hospital, local government, or public safety organization, under the guidance of the NDMS and HHS Office of Emergency Response. The sponsor signed an agreement with the federal government to place the team in the NDMS system when needed, and in exchange for allowing the team to gather experience through federal deployments (and reimbursing all deployment costs) the sponsor agreed to recruit, train and maintain the team in accordance with NDMS policies. As such, many teams are active locally and serve as state or local assets in the event of a local disaster or event. Under DHS/FEMA, however, the focus moved away from dealing with the sponsoring organization as a prime intermediary and more toward dealing directly with the team and its member personnel. While this may be a perfectly reasonable approach, many teams have not existed as legal entities separate and apart from their sponsors. In some cases the sponsoring agency has been reluctant to simply walk away from its investment in their team.

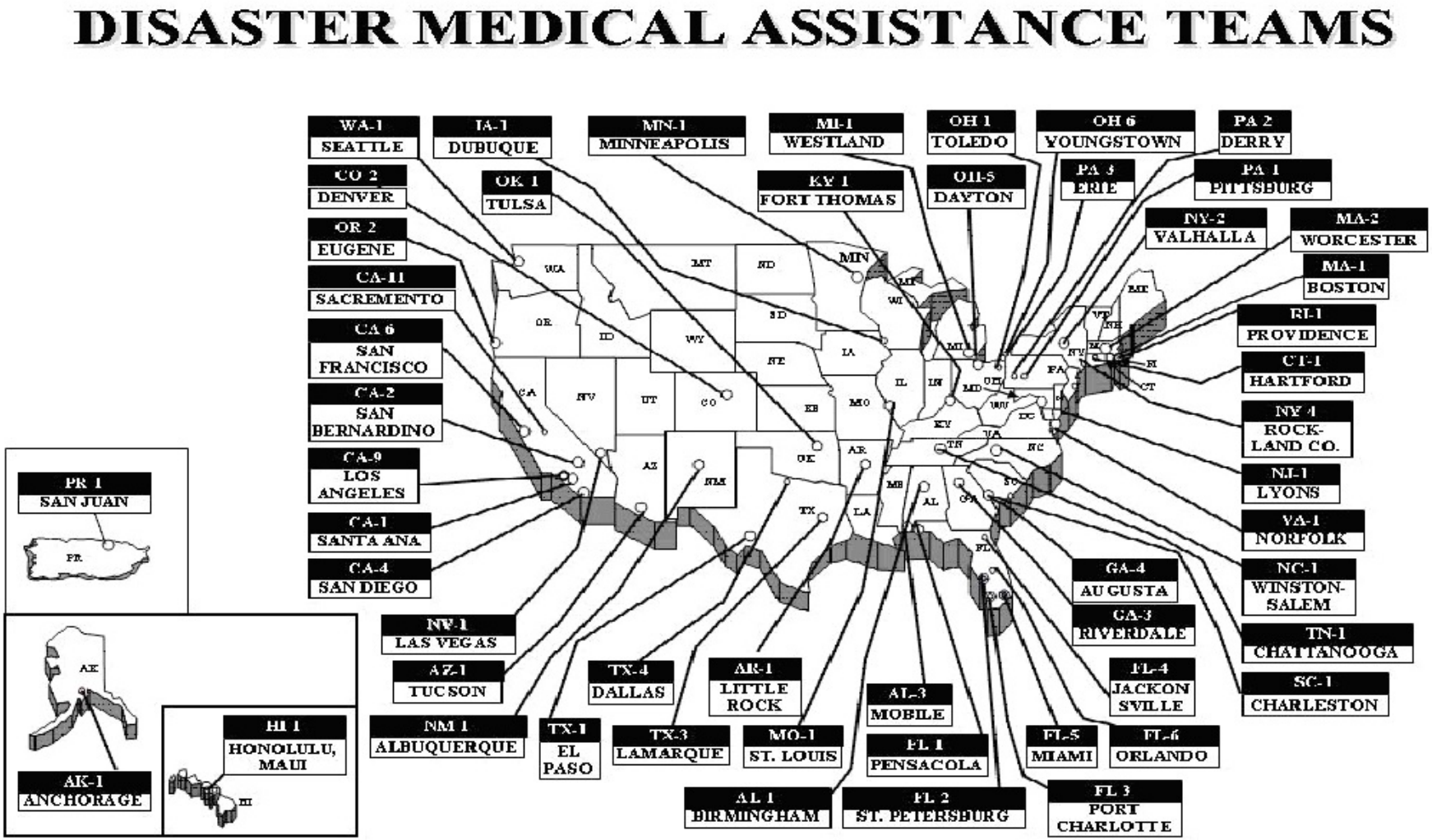

Figure 2. Geographic Distribution of Disaster Medical Assistance Teams (DMATs)

Under pre-2003 HHS leadership, prior to the move to the DHS, team members were designated as intermittent federal employees, who stayed in the payroll system as non-employees until they were "federalized" and compensated when deployed or otherwise utilized by the NDMS. This methodology left intact the volunteer nature of these team members at the federal level. Under FEMA, however, team members on intermittent employee designation were considered full-time, yet uncompensated, employees and subject to all applicable federal employee rules and ethical standards. Again, while reasonable, this status change created subtle issues for many team members who wished to pursue certain activities outside of the NDMS (Arday & Gaffney, 2004).

The most critical benefit of federalization is that it allows the team's licensed medical professionals to legally practice outside the state in which their license is issued. Federalization provides team members with liability protection under the Federal Tort Claims Act, as well as federal workers' compensation coverage for the duration of the team deployment. In addition, team members are compensated at the corresponding federal civilian employee pay grade and have the same job protections as members of the National Guard and Reserves.

Depending on the mix of casualties, a DMAT can handle up to 250 patients per 24-hour period, and can initially operate for up to 72 hours without resupply. In addition to medical supplies and equipment, teams bring their own shelter, power, communications, food and water to sustain them for three days. However, the maximal throughput assumes that most of the casualties seen will be ambulatory and have relatively minor injuries or illnesses. Depending on the availability of evacuation (transport) assets, a DMAT can reasonably handle up to 50 seriously ill or injured patients a day, providing initial stabilization for subsequent transport to a definitive care facility. But holding capacity is limited, and a DMAT has no surgical capability nor any integrated medical evacuation capability.

In addition to deploying to medically austere environments, such as disaster sites, DMATs and other NDMS teams can go into existing fixed facilities to assist or supplement overburdened local medical staff. For example, following the February 2003 Rhode Island nightclub fire, NDMS burn team personnel and equipment deployed to local hospitals in the area and supplemented existing burn ward assets. Another example is found in the Fall 2004 hurricane season. In several instances DMATs were inserted outside of pre-existing hospital emergency departments and served as triage and ambulatory care facilities. This allowed hospitals to minimize their census to victims requiring inpatient care. The teams also provided clinical providers to the hospitals themselves. This allowed some hospital staff to stand down and attend to their own personal situations; a luxury they would not otherwise have had for the duration of the post hurricane recovery period.

Patient Evacuation and Definitive Medical Care

Neither the NDMS teams nor DHS/FEMA own any patient evacuation assets. Until Hurricanes Katrina and Rita, all NDMS domestic activations relied on local private and governmental evacuation resources, primarily ground and helicopter ambulance services, to move patients from NDMS triage and treatment facilities to local and regional hospitals, as required. When these resources are exhausted military transport is usually required. In response to these two hurricanes, however, the NDMS evacuation and definitive care functions underwent activation for the first time; 900 patients were evacuated from facilities in Katrina's path and 1,200 from facilities in Rita's path.

The DoD has lead responsibility to evacuate large numbers of casualties from a major disaster location to other areas within the U.S., because it owns the vast majority of patient evacuation resources within the federal government. In such an event, control of patient staging, regulating, movement and reporting is performed by DoD, making use of the existing network of 62 Federal Coordinating Centers (FCCs).

The FCCs, which are jointly managed by DoD and the VA, provide the link between the NDMS patient evacuation and definitive care mission functions. The FCCs are concentrated in major metropolitan areas, have access to airports or helicopter pads for patients arriving or departing by air and have local hospital support. They have the responsibilities of providing patient reception and distribution, and coordinating NDMS definitive medical care in their assigned local areas. They also solicit local hospitals to participate in the NDMS and coordinate with local authorities for planning purposes or in the event of an NDMS activation that would involve local medical assets.

The NDMS has a network of roughly 1,800 local participating hospitals that have made a voluntary commitment to support the NDMS and treat its patients on a reimbursable basis, as required. The DoD and VA are the two federal agencies that jointly share responsibility for executing the NDMS definitive care mission and participating hospitals have signed joint agreements to participate in the NDMS system (all DoD and VA hospitals are automatically NDMS participants). All participating hospitals provide periodic bed availability data on a routine basis to their nearest FCC and agree to provide the same information when requested on an emergency basis. They also participate in NDMS sponsored readiness exercises (Arday & Gaffney, 2004).

Other Implications of the Pandemic and All-hazards Preparedness Act of 2006

Unfortunately, in spite of the NDMS, Katrina demonstrated that "the United States is incapable of delivering mass care" leading some to bluntly assert that the emergency medical response system is woefully inadequate, and that the National Response plan is nothing more than a vague aim (Rood, November 1, 2005, p.38). The worrisome state of pre-Katrina planning was glaringly reflected in the DHS Medical Director's 2005 call for another volunteer medical system to supplement the NDMS, apparently unaware that one already existed in the Office of the Surgeon General's Medical Reserve Corps (MRC) (Rood, 2005).

By the time of Katrina's onslaught, the MRC had over 400 units and 50,000 volunteers nationwide. Over 6,000 of these volunteers served in their own afflicted states during Katrina, and many others served in neighboring states, freeing up other volunteers to respond to the disaster zone (Franco, et al., 2006). However, MRC involvement might have been far more significant, except that the MRC was unable to mount a national scale response due to the structural inability of the community-oriented MRC Program Office to coordinate such an unplanned endeavour (Franco, et al., 2006, p.140). Still 1,500 were deployed to the disaster zone from elsewhere "through state agencies, the American Red Cross, and HHS" (Cannon cited in Franco, et al., 2006, p. 140).

FEMA's actions during Katrina also pointed out many shortcomings in operational planning and execution that adversely affected the NDMS to a certain extent. Among the many issues that the NDMS faced following its migration from HHS to DHS/FEMA was an alteration in its basic structure and mission. For example, hospitalization at or away from a disaster site is a routine part of definitive health

care and, as such, is well within the understanding and purview of HHS "the primary coordinator of the federal medical response" (Franco, et al., 2006, p.142). Conversely DHS generally, and FEMA specifically, had no clinical components or interests other than the NDMS. Another problem was that FEMA had not previously funded, nor did it have a legal mechanism to readily fund, any patient care beyond the immediate local disaster response (Arday & Gaffney, 2004).

Katrina also underlined how the "United States. simply doesn't have the medical personnel to attend to large number of casualties, or the means to distribute supplies needed to provide care to thousands of sick and injured" (Rood, pp. 44-45). NDMS, and all other health components, despite valiant efforts by those actually deployed, were inadequate to the task. Some NDMS teams were never called up despite being ready. Others found viable field missions, but were so overwhelmed that they could only provide mass triage or the rudimentary forms of first aide (Franco, et al. 2006). One well equipped DMAT was deployed to the outskirts of New Orleans, but never received authorization to enter the city despite the tremendous need and the unit's ability to respond (Franco, et. al. 2006).

These and countless other problems led think tank and executive branch analyses to conclude that the return of the NDMS to HSS (along with other fragmented volunteer medical surge programs) was necessary. The resulting legislation, the Pandemic All-Hazards Preparedness Act, redefines, clarifies and empowers a range of federal agency health disaster preparedness roles. Among its many provisions, the Pandemic All-Hazards Preparedness Act requires the HHS Secretary to critically evaluate the NDMS and to coordinate and expand extant organized medical emergency surge capacity generally.

The Act also gives the HHS Assistant Secretary for Preparedness and Response direct oversight of all public health emergencies generally and for the NDMS system specifically. Although there is still much that is open to interpretation in this new legislation, it is clear that the HHS Assistant Secretary will ramp-up, lead, staff and deploy not only the NDMS, but other health emergency surge responders who had not hitherto been under the HHS umbrella. It specifically codifies the Surgeon General's all volunteer MRC. Under this act, HHS will be broadly responsible for the integration of federal, state and local emergency medical response resources whose interstate allocation shall be coordinated through the Emergency Management Assistance Compact (EMAC) [Sec. 2811(a) - (c)]. Specifically the HHS Assistant Secretary now has the authority and responsibility for the following [Sec. 2811 (1)- (2)]:

- The National Disaster Medical System
- The Hospital Cooperative Agreement Program
- The Medical Reserve Corps
- The Emergency System for Advance Registration of Volunteer Health professionals (ESARVHP)
- The Strategic National Stockpile (in collaboration with the CDC)
- The Cities Readiness Initiative

The Act also seeks to strengthen America's health infrastructure generally by funding specific public health preparedness initiatives, including increased training for public health emergency workers, upgrading health information technology, increasing emergency care facility treatment capacity, improving influenza vaccine allocation efficiency (Sec. 204) and boosting the 6,000 member PHS Commissioned Corps' ability to quickly respond to federal and state health emergencies (Sec. 206), among many other initiatives.

Finally, in direct response to the Katrina shortfalls, the Act takes measures to increase surge capacity by promoting health volunteerism generally (Sec.303) and, specifically, non obligated unpaid service with the Medical Reserve Corps units at the "state local and tribal levels" [Sec. 2813 (a) and (b)].

THE MEDICAL RESERVE CORPS

A significant feature of this law is that it codifies the MRC, which was developed, in part, to organize volunteer medical resources to better coordinate organized volunteer surge convergence on local disaster scenes and, as a human resource backfill, to support over-extended first responders. This was also to be an antidote to the common phenomenon of spontaneous convergence of unaffiliated volunteers to disaster scenes pursuant to the type I (neighbor to neighbor helping) response that occurs in many emergencies. In most local disasters this is a good thing, especially, for example, when unskilled laborers show up to shore the dykes or help clean up after acute flood devastation.

However, when emergencies assume huge proportions, such as 9/11 and Katrina, spontaneous volunteer convergence is much more likely to contribute to the chaos and further burden emergency service officials, degrading the response infrastructure (Franco et al, 2006). Consider, for example how, under catastrophic circumstances, hordes of unaffiliated, disorganized volunteers who show up during the acute or immediate post acute phases, present profound logistical problems: Who will feed, house and protect them? Who will coordinate their services and track their involvement? And who will check their credentials and their clinical skills and abilities? If nothing else, recent disasters have pointed to the need for a "coordinated system for recruiting, deploying, and managing" organized volunteer health teams as a viable reach-back force that can enhance mitigation efforts without adding to the problem (Franco, p. 135). The MRC was developed to help meet the need for such an organized, credentialed resource.

The MRC was established by the Surgeon General in 2002, as a component of the U.S.A. Freedom Corps, to help strengthen America's health, emergency service and homeland defense infrastructure. The MRC concept is a decentralized, community based initiative intended to perform a range of self-selected emergency and non emergency public health roles, and to become integrated into their local public health and emergency preparedness and response systems. Thus, like the DMATs, MRC units reflect partnerships between many kinds of public and private health service organizations and federal agencies. Most MRC units are sponsored by county and state health departments, but others are sponsored by academic health institutions, churches, other nongovernmental agencies and two are sponsored by State Military Departments.

Unlike DMATs, MRC units are less structured, more flexible and embrace diverse mission orientations. Although many community-based MRCs chose to develop cohesive medical and health teams to serve in a surge capacity as force multipliers for local disaster relief operations, others opted to engage exclusively in non-emergency public health promotion and disease prevention initiatives. Regardless, since MRC units are primarily local resources, they have not had to meet national DMAT-like field sustainability standards, unit size or professional mix requirements, or other "set" operational status criteria. However, the passage of the Pandemic All-Hazards Preparedness Act may change this somewhat.

While the full implications of the Act remain speculative at this time, the Act specifically guarantees that the newly codified MRC will incorporate and preserve the "established existing State, local and tribal teams" [Sec. 2813, (b)]. On the other hand, in a marked departure from the past, the Act now calls for specific certification training standards, which was scrupulously avoided in the previous grassroots, community based "plant the seed and let a thousand blossoms grow" model.

Under the new Act, MRC teams must self-identify as to whether or not they are willing to serve outside of their communities, as authorized by their state or local sponsoring agencies [Sec. 2813. (e)]. This is not a new concept, as there is a track record of MRCs serving nationally, as illustrated below. Now, however, those willing to serve outside their community under the Secretary's direction are eligible to receive federal "travel or transportation expenses…including per diem in lieu of subsistence" [Sec. 2813. (f)].

To illustrate the full potential of the MRCs to augment surge responders during a catastrophic health crisis we will examine a state military sponsored MRC that partnered with a large state civilian MRC, in order to provide effective emergency surge support during the Katrina catastrophe. Before we do this, however, we should examine the military's role in providing support to civil authorities during health emergencies.

Military (Medical) Support to Civil Authorities

We have mentioned in the context of the NDMS the Department of Defense's (DoD's) role of providing military medical support to federal, state and local civil authorities (referred to by the military as Military Support to Civil Authorities or, MSCA). Since 2003, guidance for this function within the U.S. has been the responsibility of the Assistant Secretary of Defense for Homeland Defense, with implementation through the United States Northern Command (NORTHCOM), which is responsible for federal military homeland defense initiatives, including civil support for domestic medical emergencies of either a natural or human origin. Federal military support to states can occur only after a state's governor declares that a state of emergency exists and formally requests aid from the President. At this point, the President may order a military response, but such support will always be under the control of a federal civilian lead agency, such as DHS or HHS, as outlined in the National Response Plan. The military never acts as a lead federal response agency for a domestic disaster.

MSCA has three spheres of involvement in providing health related support to designated federal lead agencies: (1) military support to domestic relief operations (DRO) for natural or man made disasters; (2) support to civilian law enforcement agencies; and (3) MSCA for response to chemical, biological, radiological, nuclear and explosive (CBRNE) events (*Doctrine for civil support*, 2001). Primary medical support occurs through the DRO function which includes:

> "rescue, evacuation, and emergency medical treatment of casualties, maintenance or restoration of emergency medical capabilities, and safeguarding public health . . . the rescue or movement of people [and the]. . . recovery, identification, registration and disposal of dead bodies" (Cechine, et al., 2004, p.38).

It bears stressing that no armed forces medical unit (nor virtually any other military unit) is fully dedicated to MSCA DRO duties (Cechine, et al., 2004). Nevertheless, military help is frequently called for. For example, the DoD authorized 73 MSCA medical missions between 1998 and 2000 (Cechine,

et al.). Most of these provided evacuation services for victims using the military's vast fleets of ambulances, helicopters, transport aircraft and ships.

Generally, the U.S. military prefers to receive requests for needs as opposed to requests for specific military assets (Cechine, et al., 2004), so that it can dynamically coordinate its MSCA obligations with its higher defense priorities. As a general rule, the military involvement is greatest during the acute and immediate post acute phase, after which its involvement significantly attenuates. The military's overriding commitment to its primary defense role and its desire to avoid extended commitments of assets can lead to some misunderstandings with civil authorities. Following Kartrina, for example, FEMA claimed that the DoD had refused some missions (which the DoD has denied) (Basu, 2006, March). Regardless, the military's need to manage its resources and safeguard its essential war-making missions may contribute to qualms that some civil authorities seem to have about requesting federal military assistance (Cechine et al., 2004). Other concerns arguably spring from simple confusion about the military's role, or entail worries about losing jurisdictional control to military "top-brass" (Cechine et al.). Experience shows that, even at the municipal level, local first responders often worry that military involvement will crowd "their lane" (Nelson, et al., in press).

At the state level, however, governors are quick to rely on their state military assets (the Army and Air National Guard). In fact, the reliance on the National Guard (NG) for state disaster response is so heavy that state governors are sometimes reluctant to allow their NG units into federal service, which happened during Katrina in Louisiana, for example. Recent changes in the Insurrection Act of 1807, however, (Peterson, 2007) make this somewhat less likely, as federal law now allows the President to call-up the federalized National Guard for "natural disaster, epidemic, or other serious public health emergency, terrorist attack or incident" in addition to its time honored role " of putting down rebellions or enforcing constitutional rights. . ." (Congress cited in Peterson, no page).

State Military Medical Assets

Governors control their National Guards based on state militia laws; however, NG units are dual-hatted entities with both state and federal roles. Most NG emergency service is performed during state active duty, under command of the governor as "Commander-in-Chief," acting through the Adjutant General (TAG) of that state. However, the President, can also order the NG into federal service as part of the armed forces, with the President as Commander-in-Chief, as mentioned above.

To assure that state governors will always have state military assets for civil emergencies, even when their NG is federalized and taken out of state control, which seems more likely now than in the past, Congress passed 32 USC, Sect. 109 in 1955, which allowed the states to once again (as in WWI, WWII and before) maintain "other troops" in addition to their state NG. Federally designated as the State Defense Force (SDF), these "other troops" bear various working titles at the state level, but are invariably governed by the same state militia laws as the NG, with special provisions outlining their specific state-only missions. Most state statutes designate their SDF unit as the third component of their state's organized militia (along with the Army and Air National Guard). Officers in all three elements, for instance, are commissioned by the governor in their state role, pursuant to the same state militia law, although NG personnel can be called into federal service, while SDF personnel cannot. Presently, 22 states have an active SDF unit. Since 9/11, most of these are working to develop new missions and roles in response to emerging homeland defense concerns. These units typically serve without pay, although

legal provisions allow remuneration for compulsive state active duty (an expedient only rarely exercised since World War II, when the SDF was known as the State Guard).

All three state military assets are available to the governor for any natural or human made disaster. As mentioned, NG support to civil authorities is famously reliable in this regard, with a long history of effectively mitigating natural disasters, including, most notably, hurricanes, tornados, floods, blizzards and wildfires among other disasters (Priess, 2004). Since 9/11 the NG has adapted to emerging homeland defense needs as is reflected, for example, in their staffing state and territorial 22-member Weapons of Mass Destruction (WMD) Civil Support Teams (CST). These WMD CSTs are responsible for supporting:

> " … local and state authorities at domestic WMD/NBC incident sites by identifying agents and substances, assessing current and projected consequences, advising on response measures, and assisting with requests for additional military support" (GlobalSecurity.org, n.d.).

The United States Air Force Counterproliferation Center (2006, October 5) describes how these rapid response teams are coordinated in the field by personnel housed in mobile Unified Command Suites replete with state of the art "real-time voice, data and video connectivity (classified and unclassified)" that enables NG WMD specialists to keep civilian emergency service authorities apprised of whether or not a terrorist nuclear, biological or chemical (NBC) threat really exists and, if so, what measures are needed to achieve maximal mitigation. Identified needs in this regard will be coordinated with the Metropolitan Medical Response System (MMRS), which, in turn, helps coordinate municipal police, EMT, hospital, fire department and academic institution response to WMD, as well as other major health disasters.

Despite expanded homeland security missions, natural disasters will remain the NG's MSCA mainstay into the future as it continues to demonstrate its reliable work-horse capability to respond to countless seasonal disasters at community and state levels every year. On the other hand, true catastrophes, like Katrina, will quickly overwhelm state military assets, forcing the governor to request federal help pursuant to the Stafford Act. This allows the federal National Guard Bureau to coordinate the federal activation and deployment of other state's NG assets to the smitten area.

This influx of sister state NG units into a disaster zone can take a variety of command-and-control configurations, but suffice it to say that during major catastrophes, out-of-state federalized NG troops under NORTHCOM might well be serving alongside an afflicted state's non-federalized NG units, which usually remain under the governor's control (though not necessarily, as happened in Louisiana during Katrina). Some argue that this leads to dual command inefficiencies (Basu, 2006, March), while others counter that this allows for more flexibility at the local level. Regardless, over 58,000 Guardsmen from nearly every state responded in Katrina's aftermath, greatly relieving many thousands of stricken residents. Most of these NG troops were deployed under Title 32 (state) orders so that they would not be hamstrung by Posse Comitatus if they were asked to perform law enforcement roles. Also, most of these troops went to Louisiana and Mississippi under EMAC which left the state governors in command. Troops who were brought in under federal sway pursuant to Title 10 were effectively prevented from law enforcement duties unless Martial Law was declared, which it was not during Katrina.

Historically, unlike NG units, SDF units have not played a significant emergency service role, although their successful involvement in Katrina recovery efforts suggests movement in this direction. The Mississippi State Guard (MSSG), for example, provided medical care to that state's victims as did the Texas State Guard (TXSG), which activated its Medical Command (The TXSG Medical Rangers) for in-state service (Nelson, et al., in press). Uniquely, the Maryland Defense Force (MDDF) sent over 200 regular and temporary officers and enlisted personnel (mostly physicians, nurses and EMTs) from its10th Medical Regiment/MDDF, under Title 32 orders, to Jefferson Parish, Louisiana for three weeks of field duty.

The SDF-MRC Connection—a Joint Civil and Military Model

Prior to Katrina, both the Texas State Guard and Maryland Defense Force had registered with the Office of the Surgeon General (OSG), as uniformed MRC units. This gave these military organizations a name that was recognizable to civilian community emergency health planners and offered new avenues for technical support, including a gateway to participation with the emergency system for Advance Registration of Volunteer Health Professionals (ESAR-VHP), (an electronic database that verifies the credentials and qualifications of participating emergency medical and allied health volunteers). MRC registration also opened doors to funding opportunities without transferring any operational or command authority from the state Adjutant General to the OSG. Registration as an MRC greatly enhanced MSCA networking opportunities resulting in the MDDF's effective integration with various local and state-wide disaster response plans (Nelson, et al., in press).

The MDDF's dual role as a state military entity registered as an MRC unit with the OSG reflects a unique status, not only in terms of its federal-state relationship, but also regarding its pattern of state-local relationships. For example, the MDDF is a state agency within the Military Department of Maryland. And although it is federally authorized, it otherwise operates pursuant to the state's militia law. But it is also dual-hatted as an OSG sponsored MRC unit with a delimited MRC responsibility at the local level (Baltimore County), where it manifests under its working MRC name as the MDDF Baltimore County Emergency Volunteers (see http://www.co.ba.md.us/Agencies/health/bioterrorism/mrc.html).

Baltimore County emergency planners can request that these emergency (MRC) volunteers be activated during a local emergency, but this must be approved by the Maryland Governor, through the state Adjutant General (TAG) who commands all state military forces. MDDF medical personnel cannot act without lawful military orders, but the MDDF's excellent (military) liability and worker's compensation insurance facilitate the TAG's support of this local MSCA mission. Also, Baltimore County planners fully understand and realize that during a statewide or national emergency the MDDF may be ordered somewhere other than Baltimore County, as happened during Katrina.

The MDDF MRC During Katrina

Although nearly 1,500 MRC members served during Katrina, the MDDF (in its dual capacity) was perhaps the only MRC unit to respond to the disaster as a cohesive internally and externally integrated unit from outside the afflicted zone. Its effectiveness was, at least partially, dependent on the last minute expedient of temporarily swearing into its ranks members of another MRC activity, the Maryland Professional Volunteer Corps, which is sponsored by Maryland's Department of Health and

Mental Hygiene. The latter represents a huge pool of nearly 5,000 volunteers who can be activated by the state health department in a health crisis, but who are not organized or trained to act as a unit.

News of Katrina's devastation and urgent need for assistance prompted Maryland's Adjutant General, Major General Bruce F. Tuxill, to activate state Military Department resources, including the MDDF's 10th Medical Regiment, to prepare for a humanitarian mission to the stricken area. About 30 members of the MDDF, including six physicians, seven nurses, and other health and command and support personnel were able to voluntarily break off their civilian responsibilities to quickly assemble as the first of three MDDF cadres that would augment NG and Maryland civilian first responders who were preparing to deploy to Louisiana in three NG C130J transport planes.

When this group assembled at the Warfield ANG Base, they met another 70 or so civilian volunteers from the Maryland State Health Department's pool of MRC volunteers. As indicated above, these civilian volunteers were all experienced practitioners, but had never worked as a unit before. Moreover, since there was not yet a formal request for their services through the interstate EMAC, their deployment was not completely certain. Further, without a formal EMAC request, they had no liability coverage and were not protected by workers compensation, unlike their MDDF counterparts.

NG officials, who were ready to fly the whole group to Louisiana and wanted to avoid unnecessary delays, seized upon the idea that these otherwise acephalous and legally vulnerable civilian MRC volunteers could be easily be sworn into the MDDF on a temporary, and entirely legal basis, allocating them military rank based on their education and civilian health credentials, making them "*bona fide* state military personnel" for their term of service. This would afford them "absolute immunity from suit for any act done within the scope of their MDDF 10th Medical Regiment duties" (Nelson, et al., in press). It also provided them other military benefits if they were injured in the line of duty in addition to military air transport, billeting, security and other forms of sustenance and supplies. Moreover, they could serve under the MDDF's experienced command personnel, gaining a sense of order, support and accountability that was otherwise unavailable.

Although the EMAC request was eventually processed, the improvised military swearing in worked so well that during the course of the operation (5-21 September 2005) nearly 200 MRC volunteers working under the MDDF command effectively staffed up to six clinics in Jefferson Parish, Louisiana and treated over 6,200 patients. Moreover, these (hitherto) civilian MRC members found this temporary military experience to be so positive that nearly half of them chose to stay with the MDDF on a permanent basis after Katrina.

Although a full discussion of events during this deployment is beyond the scope of this paper, this military MRC model approximates the proposal made by former DHS Security Secretary Tom Ridge's medical advisor Dr. Jeffrey Lowell, who called for a medical surge corps "on the model of the National Guard, complete with rank and uniform" (Rood, 2005, p. 45). But, can America's State Defense Force help fulfill this vision on a larger scale? Evidence suggests yes, and in the same tradition of state-federal partnerships blazed by volunteer DMATs and MRC activities that continue to hold great promise in meeting America's need for organized surge medical capacity.

Why did the Maryland SDF (uniformed MRC) succeed in finding a viable out-of-state disaster relief mission for which it had neither planned nor trained, when some NDMS teams and most MRCs were unable to? There are many reasons for this, including, no doubt, a measure of luck. But the lion's

share of credit goes to Maryland's TAG and other State Military Department personnel who seized a new vision for state military emergency resources in a time of compelling need. Cooperation from the Maryland Department of Health and Mental Hygiene was also crucial, as potential turf concerns were swept aside to solve problems that might have otherwise taken months to resolve. MDDF commanders also deserve credit, not only for the smooth operation of this unique joint deployment, but also for finding the Jefferson Parish Mission after the first requested hospital support mission fell through.

SUMMARY

America's surge capacity medical infrastructure was in many respects launched in 1984, when the National Disaster Medical System, in a partnership between and among many public and private sector organizations and four federal agencies, emerged. Although this system has provided a critical service to those with medical needs, 9/11 and recent reassessments of the current medical threat environment pointed to emerging threats that have lead to the development of other surge responders, including the Surgeon General's MRC, reemphasis upon DoD and NG health related missions, and an incipient revival and expansion of SDF medical missions.

The recent passage of the Pandemic and All-hazards Preparedness Act presents a renewed call for organized health volunteerism generally, and is a mandate for strengthening of all emergency health preparedness initiatives, as well as a strengthening of the uniformed Public Health Service and Veterans Administration to help meet emerging medical, mental health, mortuary and veterinary disaster response needs. Although the nation's medical system has struggled with the jurisdictional changes since 9/11 - it remains evident that America's emergency health volunteers will continue as never before to come to the aid of those with medical needs after a disaster befalls them.

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APPENDIX

LIST OF ACRONYMS AND ABBREVIATIONS FREQUENTLY ASSOCIATED WITH DISASTER MEDICAL RESPONSE

Acronym and Abbreviation	Definition
CBRNE	Chemical, biological, radiological, nuclear, explosive (event)
DHS	Department of Homeland Security
DMAT	Disaster Medical Assistance Team
DMORT	Disaster Mortuary Operations Response Team
DoD	Department of Defense
EMA	Emergency Management Agency (state or local)
EMAC	Emergency Management Assistance Compact
FCC	Federal Coordinating Center
FCO	Federal Coordinating Officer
FEMA	Federal Emergency Management Agency
FRP	Federal Response Plan
HAZMAT	Hazardous materials
HHS	Department of Health and Human Services
ICS	Incident Command System
IMSuRT	International Medical Surgical Response Team

LIST OF ACRONYMS AND ABBREVIATIONS FREQUENTLY ASSOCIATED WITH DISASTER MEDICAL RESPONSE

Acronym and Abbreviation	Definition
MCI	Mass casualty incident
MDDF	Maryland Defense Force
MRC	Medical Reserve Corps
MSCA	Military Support to Civil Authorities
NDMS	National Disaster Medical System
NG	National Guard
NMRT	National Medical Response Team
NNRT	National Nurse Response Team
NPRT	National Pharmacist Response Team
NRP	National Response Plan
TAG	The Adjutant General (within state military organization)
VA	Department of Veterans Affairs
VMAT	Veterinary Medical Assistance Team
WMD	Weapons of mass destruction